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5. 'Great Changes of Level in Mexico, and the Inter-Oceanic Connections,' by J. W. Spencer. The geological basement of Mexico is a post-Cretaceous base level, out of which rise the higher mountains. A deep-water formation of Mio-Pliocene age rests unconformably upon the Cretaceous. These rocks, by their distribution, point to a Pliocene submergence, with 'canals' or straits connecting the Pacific and Gulf waters. This conclusion is further substantiated by the similarity of the shallow water faunas on the opposite sides of the isthmus, the deeper water forms being quite unlike. This connection was broken by a recent, almost modern, elevation, amounting, in some places, to 8,000 feet.

6. 'The Origin of the Gorge of the Whirlpool Rapids of Niagara,' by F. B. Taylor. From the falls to the cantilever bridge the Niagara gorge is broad. At the latter point it suddenly narrows, and the diminished width continues to within eighty rods of the whirlpool. From here to Lewiston it is wide again. The author ascribed the formation of the broad upper and lower gorges to the action of the great cataract carrying the entire discharge of the upper lakes. The narrow gorge of the whirlpool rapids was referred to a smaller cataract, when the three upper lakes were draining through the Nipissing into the Ottawa. Thus, the latter gorge, being cut by a comparatively small river, must have required for its formation a long time, probably not less than 20,000 to 25,000 years. This considerable period must, therefore, be reckoned with in estimating post-glacial time.

7. 'The Glacial Drainage of the Simcoe Area in Ontario,' by F. B. Taylor. In this paper the author gave reasons for believing that during a period when the Nipissing outlet was closed, a drainage channel was established from Georgian Bay through the River Trent.

8. 'Exposures near Detroit of Helderberg Limestone, and Associated Gypsum Salt, and Sandstone,' by W. H. Sherzer. The highest rocks exposed in southeastern Michigan are Upper Helderberg, nearly or quite equivalent to Corniferous. They are very pure limestones with chert beds, and have a thickness of 100–160 feet. Beneath them is a series equivalent to the Water-lime, chiefly drab dolomites, sometimes oölitic. Some distance below the top of the Water-line is intercalated a bed of white sand, almost pure quartz, many of whose grains show secondary enlargment. Extending to a depth of over 2,000 feet beneath Detroit is a series of beds of gypsum and rock salt, the latter aggregating a thickness of five hundred feet in three beds. Thus, Detroit possesses, in almost unlimited quantities, the pure limestone and salt which are the raw materials of the soda ash and caustic soda industry.

The following papers were read by title:

9. 'Notes on the Geology of the Lower Peninsula of Michigan,' by A. C. Lane.

10. 'The Nomenclature of the Carboniferous Formations,' by R. T. Hill.

11. 'Ice-transported Boulders in Coal Seams,' by E. Orton.

12. 'Clay Veins Vertically Intersecting Coal Measures,' by W. S. Gresley.

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REGENERATION IN OLIGOCHAETE WORMS.

Professor T. H. Morgan, of Bryn Mawr, has made the following summary of recent studies upon regeneration in worms:*

1. Pieces of the anterior end of Allolobophora fœtida containing less than thirteen segments rarely, if ever, regenerate posteriorly, yet such pieces can regenerate very quickly anterior segments if these are cut off. The result shows that the lack of power of the anterior pieces to regenerate

* Archiv für Entwickelungsmechanik, V. Band, 3 Heft.

posteriorly does not depend, directly, on the size of the piece. 2. Anterior ends containing from thirteen (?) to thirty segments sometimes regenerate posteriorly, but only after a long time and in general, the shorter the piece (*i. e.*, the nearer the cut to the anterior end) the longer the interval before it begins to regenerate, and the fewer the pieces that regenerate at all. 3. Similarly very short posterior pieces do not regenerate anteriorly; longer pieces from the posterior end regenerate occasionally, but only after a long interval of time. In general the shorter the posterior piece the longer the time before the piece begins to regenerate anteriorly. 4. The experiments show that Weismann's hypothesis of latent cells is insufficient to explain the phenomena of regeneration, because it can not account for the delay in regeneration of a lost part under the circumstances given above. 5. Short pieces from the middle of the worm sometimes regenerate both anteriorly and posteriorly. 6. If a worm be cut in two pieces and then the anterior end be cut off again from the anterior piece, the middle piece will regenerate posteriorly at the same rate and time as though the anterior end had not been cut off. 7. If posterior ends of two worms be sewed together and if then one of the ends has a part cut off, the part that regenerates is like the part removed; *i. e.*, a new posterior end, and not a new head regenerates.

The power to regenerate is, in some cases, of the greatest use to an animal since it enables the animal, if injured, to reproduce the lost parts. It is, therefore, surprising to find the phenomenon of regeneration almost entirely neglected by the advocates of the theory of natural selection. Darwin scarcely alludes to the matter and most of his followers make little or no reference to the subject. Weismann, however, in his recent book on the Germ Plasm has opened up the question. A quotation will serve to show how successfully he has treated the matter from the selectionists' standpoint. "The power of regeneration in any particular part cannot depend only on the conditions which exist as regards the species under consideration; it must also be due to arrangements for regeneration which have been transmitted by the ancestors of the species. Leaving the question aside, and regarding the power of regeneration as merely depending in each individual case on adaptation, we should arrive at some such conclusion as the following: the provision of the cells of a certain part with supplementary determinants for the purposes of regeneration depends primarily on the liability of this part to frequent injury * * * * a useless or almost useless rudimentary part may often be injured or torn off without causing processes of selection to occur which would produce in it a capacity for regeneration." How an infinite number of injuries to a part could ever produce in it a capacity for regeneration is far from clear. Injured animals would be, on the whole, at a disadvantage in the struggle for existence; if some of them have the power to regenerate already they are neither better nor worse off than those that have not been injured. Just how injured animals would ever be able in each generation to obtain an advantage over uninjured animals is by no means self-evident. In my experiments, for instance, I find that only rarely do posterior ends of worms cut in the middle regenerate anteriorly, and even in those cases where this happens the regeneration is almost always imperfect. Does this mean that as yet an insufficient number of these worms have been injured in this way? In the course of time if more worms are injured by accidents, will Allolobophora fœtida acquire a capacity for regenerating the anterior end? Are we to consider seriously this interpretation of the selection theory?